

FILE COPY

SDMS DOC ID# 1118387

SUBSURFACE INVESTIGATION PHASE 1 REPORT OF FINDINGS

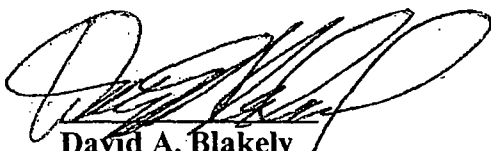
ENVIRONMENTAL
SOUTHERN CALIFORNIA SITE INVESTIGATION BRANCH

OUT 11 1 2002

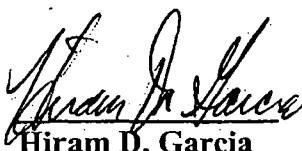
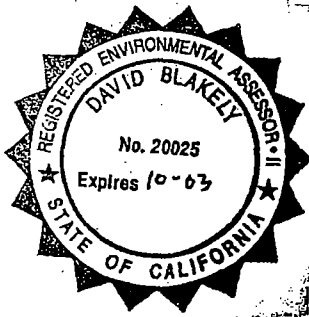
RECEIVED

FORMER ANGELES CHEMICAL COMPANY 8915 SORENSEN AVENUE SANTA FE SPRINGS, CALIFORNIA

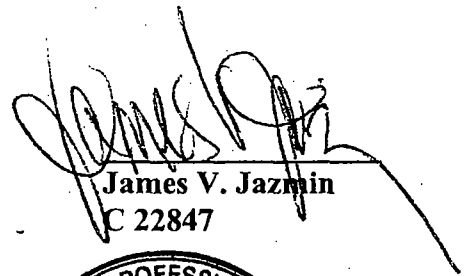
Prepared by:
Blakely Environmental Investigations, Inc.
9605 Arrow Route, Suite T
Rancho Cucamonga, CA 91730
(909)-989-9550



David A. Blakely
Sr. Scientist
REA II #20025



Hiram D. Garcia
REA II #20048



James V. Jazmin
C 22847



October 15, 2002

TABLE OF CONTENTS

1.0)	INTRODUCTION	1
2.0)	SITE LOCATION AND HISTORY	1
3.0)	REGIONAL GEOLOGY/HYDROGEOLOGY	3
4.0)	SITE GEOLOGY/HYRDOGEOLOGY	4
5.0)	SOIL GAS SURVEY (SGS) COLLECTION	5
6.0)	SOIL GAS SURVEY (SGS) RESULTS	6
7.0)	BORING AND GROUNDWATER WELL SAMPLE COLLECTION	9
8.0)	BORING AND GROUNDWATER WELL SOIL SAMPLE RESULTS	10
9.0)	CONCLUSIONS	14
10.0)	RECOMMENDATIONS	14

FIGURES

Figure 1	Site Location Map
Figure 2	Well Location Map
Figure 3	Depth to Groundwater
Figure 4	BEII Soil Gas Sample Locations
Figure 5	Concentrations of BTEX in Soil Gas at 5' bg
Figure 6	Concentrations of BTEX in Soil Gas at 7'-12' bg
Figure 7	Concentrations of BTEX in Soil Gas at 20' bg
Figure 8	Concentrations of 1,1 DCA in Soil Gas at 5' bg
Figure 9	Concentrations of 1,1 DCA in Soil Gas at 7'-12' bg
Figure 10	Concentrations of 1,1 DCA in Soil Gas at 20' bg
Figure 11	Concentrations of 1,1 DCE in Soil Gas at 5' bg
Figure 12	Concentrations of 1,1 DCE in Soil Gas at 7'-12' bg
Figure 13	Concentrations of 1,1 DCE in Soil Gas at 20' bg
Figure 14	Concentrations of cis-1,2 DCE in Soil Gas at 5' bg
Figure 15	Concentrations of cis-1,2 DCE in Soil Gas at 7'-12' bg
Figure 16	Concentrations of cis-1,2 DCE in Soil Gas at 20' bg
Figure 17	Concentrations of PCE in Soil Gas at 5' bg
Figure 18	Concentrations of PCE in Soil Gas at 7'-12' bg
Figure 19	Concentrations of PCE in Soil Gas at 20' bg
Figure 20	Concentrations of 1,1,1 TCA in Soil Gas at 5' bg
Figure 21	Concentrations of 1,1,1 TCA in Soil Gas at 7'-12' bg
Figure 22	Concentrations of 1,1,1 TCA in Soil Gas at 20' bg

TABLE OF CONTENTS (continued)

Figure 23	Concentrations of TCE in Soil Gas at 5' bg
Figure 24	Concentrations of TCE in Soil Gas at 7'-12' bg
Figure 25	Concentrations of TCE in Soil Gas at 20' bg
Figure 26	Concentrations of VC in Soil Gas at 5' bg
Figure 27	Concentrations of VC in Soil Gas at 7'-12' bg
Figure 28	Concentrations of VC in Soil Gas at 20' bg
Figure 29	Estimated Extent of BTEX in Soil Gas at 20' bg
Figure 30	Estimated Extent of 1,1 DCA in Soil Gas at 20' bg
Figure 31	Estimated Extent of 1,1 DCE in Soil Gas at 20' bg
Figure 32	Estimated Extent of cis-1,2 DCE in Soil Gas at 20' bg
Figure 33	Estimated Extent of PCE in Soil Gas at 20' bg
Figure 34	Estimated Extent of 1,1,1 TCA in Soil Gas at 20' bg
Figure 35	Estimated Extent of TCE in Soil Gas at 20' bg
Figure 36	Estimated Extent of VC in Soil Gas at 20' bg
Figure 37	BEII Well/Boring Locations
Figure 38	South-North Lithologic Cross Section Along A-A'
Figure 39	East-West Lithologic Cross Section Along B-B'
Figure 40	Proposed Boring and CPT Locations

TABLES

Table 1	January 2002 Soil Gas Survey Results Collected at 8' bg and 20' bg
Table 2	January 2002 Soil Gas Survey Results Collected at 5' bg, 10' bg, and 20' bg
Table 3	June 2002 Soil Gas Survey Results Collected between 7' bg and 12' bg
Table 4	June 2002 EPA Method 8015 Soil Sample Results for TPH
Table 5	June 2002 EPA Series 7000 Soil Sample Results for Metals
Table 6	June 2002 EPA Method 8260 Detectable Soil Sample Results for VOCs

APPENDICES

Appendix A	Soil Gas Survey Laboratory Results
Appendix B	Boring Logs/Well Construction
Appendix C	Soil Sample Laboratory Results

**Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002**

1.0) INTRODUCTION

Blakely Environmental Investigations, Inc. (BEII) was contracted by Greve Financial Services, Inc. ((310) 753-5770) to perform a soil gas survey (SGS) to determine the lateral extent of volatile organic compounds (VOCs) in soil vapors along the southern and eastern property line of the former Angeles Chemical Co. (Angeles) facility located at 8915 Sorensen Avenue, Santa Fe Springs, California (See Figure 1, Site Location Map). In addition, a SGS was performed on the Air Liquide property located north of the Angeles facility. Furthermore, two soil borings and two groundwater wells were advanced to define the lateral and vertical extent of impacted soil along the eastern Angeles property line and to determine the extent of impacted groundwater. The SGS, boring advancement, and well installation was performed at the request of the Department of Toxic Substances Control (DTSC), the regulatory lead agency, to help determine the extent of volatile organic compounds (VOCs) identified in OU-1 (operable unit) along the northern railroad spurs and OU-2 along the southern boundary of the property. This report details the results of this first of several phases of subsurface investigation work to be performed at the site as requested by the DTSC.

2.0) SITE LOCATION AND HISTORY

The site is approximately 1.8 acres in size and completely fenced. The site was bound to Sorensen Avenue on the east, Liquid Air Corporation to the northwest, Plastall Metals Corporation to the north, and a Southern Pacific Railroad easement and McKesson Chemical Company to the south.

The property was owned by Southern Pacific Transportation Company and was not developed until 1976.

The Angeles Chemical Company has operated as a chemical repackaging facility since 1976. A total of thirty-four (34) underground storage tanks (USTs) existed beneath the site. Two USTs, one gasoline and one diesel, and ten chemical USTs were excavated and removed under the oversight of the Santa Fe Springs Fire Department. Twelve (12) chemical USTs were decommissioned in place and slurry filled. Ten (10) remaining USTs used for secondary containment of surface runoff were decommissioned by removal or slurry filling in July 2001, under the oversight of the Santa Fe Springs Fire Department. Chemicals which have been stored and used on site include, but are not limited to, acetone, methylene chloride, 1,1,1-trichloroethane (1,1,1-TCA), tetrachloroethene (PCE), methyl ethyl ketone (MEK), toluene, xylene, kerosene, diesel, and unleaded gasoline.

In January 1990, SCS conducted a site investigation. SCS advanced eight borings from 5' below grade (bg) to 50' bg. Soil samples collected and analyzed identified benzene, 1,1-

Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002

Dichloroethane (1,1-DCA), 1,1-Dichloroethene (1,1-DCE), MEK, methyl isobutyl ketone (MIBK), toluene, 1,1,1-TCA, PCE, and xylenes at detectable concentrations.

In June 1990, SCS performed an additional site investigation at the site by advancing six additional borings advanced from 20.5' bg to 60' bg. A monitoring well (MW-1) was also installed. Soil sample analysis identified detectable concentrations of the above mentioned VOCs in addition to acetone and methylene chloride. Dissolved benzene, 1,1-DCA, 1,1-DCE, PCE, TCE, and trans-1,2-dichloroethene were detected in MW-1 above maximum contaminant levels.

Between 1993 and 1994, SCS performed further testing at the site. Soil samples were collected from nine borings. Five borings were converted to groundwater monitoring wells MW-2, MW-3, MW-4, MW-6, and MW-7 (See Figure 2, SCS Well/Boring Location Map). The predominant compounds detected in soil were acetone, MEK, MIBK, PCE, toluene, 1,1,1-TCA, TCE, and xylenes. Groundwater sample collection performed in February 1994 by SCS identified the following using EPA method 624 (laboratory results included in Remedial Investigation Report dated August 1994 by SCS):

Component Analyzed	MW-1	MW-2	MW-3	MW-4	MW-6	MW-7
Benzene	194	<100	63	111	795	46
1,1-DCA	649	1,130	85	1,410	2,260	2,130
1,2-DCA	<100	<100	<50	<100	1,140	31
1,1-DCE	2,210	2,460	2,800	806	1,240	151
Ethylbenzene	333	1,720	115	1,180	1,910	45
Methylene Chloride	1,220	2,980	6,530	4,760	21,400	<50
PCE	662	2,150	5,370	3,320	2,130	134
Toluene	560	7,390	579	12,700	13,500	398
1,1,1-TCA	9,370	3,470	444	36,200	114,000	90
TCE	7,160	3,040	1,730	14,300	1,320	45
Xylenes	1,750	7,790	1,014	4,362	4,710	186
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L

In 1996, SCS performed separate soil vapor extraction pilot testing beneath the site at approximately 10' bg and 22' bg. Laboratory analysis identified maximum soil vapor gas concentrations as 1,1,1-TCA (30,300 ppmV) with detectable concentrations of 1,1-DCE, TCE, methylene chloride, toluene, PCE and xylenes. The maximum radius of influence from the various extraction units used were measured as 35 feet at 10' bg and 80 feet at 22' bg.

In November 1997, SCS performed a SGS at the site. Soil vapor samples were collected at twenty-three locations at 5' bg. In addition, soil vapor samples were collected at 15' bg in

**Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002**

five of the twelve sampling points. The soil vapor survey identified maximum VOC contaminants near the railroad tracks on site, the location where a rail tanker reportedly had an accidental release.

In September 2000, Blaine Tech Services, Inc. gauged the six on-site monitoring wells (MW-1, MW-2, MW-3, MW-4, MW-6, and MW-7) under the supervision of BEII. Free product (FP) was identified in monitoring well MW-4 at 0.21-feet in thickness. Approximately 0.5 liters of FP were removed from the well and placed in a sealed 55-gallon drum.

BEII performed a SGS at the site from November 27 to December 1, 2000. A total of 36 soil vapor sample points, labeled SV1 through SV36, were selected by BEII and approved by the DTSC for analysis. Two discrete soil vapor samples were collected from each soil vapor sample point, one at 8' bg and one at 20' bg. SV1 was an exception since the first soil vapor sample was collected at 10' bg instead of 8' bg. Based on the soil vapor sample results, BEII identified relatively low level concentrations of VOCs in the silty clay soils at 8' bg. However, the concentrations of VOCs are significantly higher in the sandy soils at 20' bg in OU-1. Results were submitted to the DTSC by BEII in a Report of Findings dated January 10, 2001 with laboratory reports.

On November 30, 2000, Blaine Tech Services, Inc. (Blaine) was contracted to perform groundwater sampling at the site. Groundwater monitoring wells MW-4 and MW-6 were not sampled due to insufficient water and presence of free product. These wells were installed to monitor a perched groundwater body to the north. Free product was identified in MW-1 during sample collection, upon completion of well purging. The potentiometric groundwater level was above the well screen. Groundwater purging lowered the potentiometric level below the screened interval, allowing free product to enter. Groundwater sample analysis identified thirteen constituents of concern (COCs) in the dissolved phase as VOCs only. Laboratory analysis of metals and SVOCs identified concentrations below allowable levels for those constituents. Results were submitted by BEII to the DTSC in a Report of Findings dated January 10, 2001 with laboratory reports.

The remaining USTs have been excavated or slurry filled for closure under the supervision of the Santa Fe Springs fire Department. A report was submitted to the DTSC upon completion by EREMCO.

3.0) REGIONAL GEOLOGY/HYDROGEOLOGY

The site is located near the northern boundary of the Santa Fe Springs Plain within the Los Angeles Coastal Plain at an elevation of approximately 150 feet above mean sea level. Surficial sediments consist of fluvial deposits composed of inter-bedded gravel, sand, silt, and

**Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002**

clay. Available data from California Water Resources Bulletin No. 104 (June 1961) indicate that the surficial sediments may be Holocene and/or part of the upper Pleistocene Lakewood Formation, which ranges from 40 to 50 feet thick beneath the site. The Lakewood Formation has lateral lithologic changes with discontinuous permeable zones that vary in particle size. Stratified deposits of sand, silty sand, silt, and fine gravel comprising the upper portion of the lower Pleistocene San Pedro Formation underlies the Lakewood Formation.

The site lies within the Central Basin Pressure area, a division of the Central Ground Water Basin, which extends over most of the Coastal Plain. The Gasper aquifer, a part of the basal coarse unit of Holocene deposits, is found within old channels of the San Gabriel and other rivers. The Gasper aquifer may be 40-feet in thickness, with its base at a depth of about 80 to 100-feet bg. The underlying Gage aquifer is found within the upper Pleistocene Lakewood Formation. The Hollydale aquifer is the uppermost regional aquifer in the San Pedro Formation. Bulletin 104 indicates that this aquifer averages approximately 30-feet in thickness in this area, with its top at a depth of about 70 feet bg. The major water producing aquifers in the region are the Lynwood aquifer located approximately 200-feet bg, the Silverado aquifer located at approximately 275-feet bg, and the Sunnyside aquifer located at approximately 600-feet bg.

4.0) SITE GEOLOGY/HYDROGEOLOGY

SCS identified silty clays with some minor amounts of silt and sand in the shallow subsurface from surface grade to approximately 15' bg. Below the silty clay, poorly sorted coarse-grained sand and gravel was identified from 15' bg to 26' bg. SCS referenced a less permeable silty clay layer between 35' and 50' bg, which contained stringers of fine sand and silt that is part of the Gaspar/Hollydale aquifer.

A perched aquifer was encountered at approximately 23' bg by SCS and referenced as such by SCS. Based on a review of McKesson files, Harding Lawson Associates (HLA) stated that in January 1975 prior to McKesson operating their neighboring facility, no groundwater was encountered to a depth of 45' bg beneath the McKesson property. In March 1986, during operation of the neighboring McKesson facility, groundwater was encountered at 22' bg beneath the McKesson property as stated by HLA. Based on the HLA statements, BEII concludes with SCS that the first encountered groundwater is part of a shallow perched aquifer. Monitoring wells MW-4 and MW-6 will be noted as perched water monitoring wells.

SCS also referenced that the Gaspar/Hollydale aquifer was encountered at 20' to 35' bg beneath the site. Further review of Bulletin 104 by BEII, identified that the SCS referenced Gaspar/Hollydale aquifer was in fact the Gage/Hollydale aquifer. Monitoring wells MW-1, MW-2, MW-3, and MW-7 will be noted as Gage/Hollydale monitoring wells.

Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002

The groundwater gradient flowed historically to the southwest as identified by SCS. In February 2002, the groundwater was identified between 29.21' bg to 37.39' bg beneath the site. BEII recommends an additional monitoring well in the Gage/Hollydale Aquifer to calculate the groundwater gradient beneath the site, since monitoring wells MW-1, MW-2, and MW-3 are in a straight line of each other. Figure 3 contains the depth to water in each well in feet below grade with the well elevations given as feet above mean sea level.

5.0) SOIL GAS SURVEY (SGS) COLLECTION

BEII performed a SGS on the Angeles site from January 14 to January 17, 2002. The purpose of the soil gas survey was to determine the lateral extent of VOC soil vapors in the vadose zone along the eastern, northern, and southern property line of the site (OU-1 and OU-2). In addition, BEII performed a SGS on June 13, 2002 on the Air Liquide property to determine the lateral extent of VOC soil vapors in the vadose zone north of the Angeles facility (OU-1). A mobile laboratory provided by HP Labs was used at both SGS's for on-site field analysis to make real time field decisions. The work was approved and performed under the supervision of the DTSC, the lead regulatory agency overseeing the site and the direct supervision of a registered civil engineer.

A direct push rig provided by HP Labs was used to collect discrete soil vapor samples according to their standard operating procedure (SOP) submitted in the Subsurface Investigation Work Plan dated April 25, 2002 and approved by the DTSC. A total of thirty (30) soil gas sample points, labeled SV-37 through SV-67, were selected by BEII and the DTSC for analysis (See Figure 4 for BEII Soil Gas Sample Locations). Soil gas was collected at three discrete depths, 5' bg, 10' bg and 20' bg, in SV-39 through SV-44 along the southern property line. Soil gas sample points SV-62 and SV-63 were collected at 10.5' bg and SV-66 and SV-67 at 7' bg due to Strataprobe refusal. SV-61, SV-64, and SV-65 were collected at 12' bg and 20' bg. The remaining soil gas locations were sampled at two discrete depths, 8' bg and 20' bg.

Soil gas samples were collected in tight syringes and analyzed on-site by Mobile One Laboratories, Inc., a certified California Department of Health services mobile laboratory (certificate #: 1194, 1561, 1921, 2088, and 2278) for VOCs using EPA method 8260 according to the Subsurface Investigation Work Plan dated April 25, 2002. Each syringe was properly labeled with the date and time of sample collection, the soil gas location, and depth. A total of six soil gas samples (SV-40 at 20' bg, SV-45 at 20' bg, SV-50 at 20' bg, SV-55 at 20' bg, SV-60 at 20' bg, and SV-65 at 20' bg) were also collected in Summa canisters for off-site analysis at Advanced Technology Laboratories or STS Laboratories using EPA method TO14. Soil gas sample collection was performed in accordance with LARWQCB guidelines and the field sampling plan submitted in the Subsurface Investigation Work Plan dated April 25, 2002, which was approved by the DTSC.

Report of Findings

Former Angeles Chemical Company

0702-171

A tracer test using isopropyl alcohol was conducted as quality assurance for soil gas sample collection at the request and supervision of the DTSC. No detectable concentrations of isopropyl alcohol were identified in all soil gas samples analyzed. Soil gas results identified that the collection apparatus was adequate for collection of a representative soil gas sample.

In addition, a site-specific purge volume versus contaminant concentration test was performed prior to the soil vapor survey. Based on the soil vapor results, a minimum purge rate of three volumes (approximately 87 cubic centimeters) was determined adequate for the site.

6.0) SOIL GAS SURVEY (SGS) RESULTS

The soil gas survey results identified eleven detectable constituents of concern (COCs) in the vapor phase beneath the site (See Appendix A for laboratory results). The eleven COCs identified in soil gas for the site are as follows: Benzene, 1,1-DCA, 1,1-DCE, cis-1,2-DCE, Ethylbenzene, PCE, 1,1,1-TCA, TCE, Toluene, Xylene, and Vinyl Chloride (VC). PCE, 1,1,1-TCA, Toluene, and Xylene were stored on-site; 1,1-DCA, 1,1-DCE, cis-1,2-DCE, TCE, and VC are transform products of PCE, TCE, and 1,1,1 TCA; and Benzene and Ethylbenzene are components of gasoline, which was also stored on-site.

Based on the soil gas survey results, BEII identified relatively low level concentrations of COCs in the silty clay soils at 5' bg, 7'bg, 8' bg, 10' bg, and 12' bg (See Table 1 through Table 3 for soil gas results). However, the concentrations of COCs are significantly higher in the sandy soils at 20' bg, which are more permeable and conducive to soil vapor migration. Furthermore, January and June 2002 COC soil gas concentrations were higher along the southern property line (OU-2) than along the east and north property line. Figures 5 through 28 identify the January and June 2002 soil vapor concentrations of the COCs beneath the site at 5' bg, 7' to 12' bg, and 20' bg.

Soil gas BTEX concentrations were identified along the southern property line at 5' bg with a maximum of 14.9 µg/L in SV-42 (See Figure 5). At 7' to 12' bg, BTEX concentrations in soil gas were identified along both the southern and northern property line. However, the majority of soil gas BTEX concentrations were contained to the south with a maximum concentration of 132 µg/L in SV-42 (See Figure 6). The soil lithology was mostly silty clay from surface to 19' bg. Figure 7 also identified BTEX concentrations in soil gas along both the southern and northern property line at 20' bg. The maximum BTEX was identified in SV-47 located near the southern property line at 1,594 µg/L, with four other nearby soil gas points above 1,000 µg/L. The highest soil gas BTEX concentration to the north was only 224.7 µg/L in SV-64. The elevated soil gas BTEX concentrations identified along such a large extent of the south side suggest that an off-site source may exist or existed to the south.

Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002

Concentrations of 1,1 DCA, a transform compound of 1,1,1 TCA and 1,1 DCE, were detected in soil gas at 5' bg along the southern property line at a maximum of 67 µg/L in SV-41 (See Figure 8). Soil gas concentrations of 1,1 DCA were detected at 7' to 12' bg along the northern and southern property lines with a maximum of 72 µg/L in SV-40 (See Figure 9). At 20' bg, 1,1 DCA soil gas concentrations were also identified along both the southern and northern property line. The concentrations of 1,1 DCA were detected at an order of magnitude higher in the permeable sands along the southern property boundary than the northern property line at 20' bg. The maximum 1,1 DCA soil gas concentration was 2,500 µg/L in SV-41 along the southern boundary with five nearby soil gas points above 1,000 µg/L (See Figure 10). Concentrations of 1,1 DCA were identified at a maximum of only 280 µg/L along the northern boundary in SV-64 at 20' bg. The higher concentrations of 1,1 DCA along most of the south property line suggest that an off-site source may be present to the south.

Soil gas concentrations of 1,1 DCE, a transform compound of 1,1,1 TCA and TCE, were identified along the southern property line at 5' bg with a maximum of 61 µg/L in SV-40 (See Figure 11). At 7' to 12' bg, 1,1 DCE concentrations in soil gas were identified along the southern, northern, and eastern property line. The maximum 1,1 DCE soil gas concentration was identified in SV-40 as 81 µg/L along the southern property line in the impermeable clays (See Figure 12). Figure 13 also identified 1,1 DCE concentrations in soil gas along the southern, northern, and eastern property line at 20' bg. The maximum 1,1 DCE soil gas concentration was identified in SV-64 at 1,100 µg/L in the permeable sands. The soil gas sample results identified an areally pervasive 1,1 DCE plume which suggests both an on-site and off-site source at 20' bg.

Concentrations of cis-1,2 DCE, a transform compound of 1,1,1 TCA and TCE, were detected in soil gas at 5' bg along the southern property line at a maximum of 37 µg/L in SV-44 (See Figure 14). Soil gas concentrations of cis-1,2 DCE were detected at 7' to 12' bg south, north, and east along the property lines with a maximum of 120 µg/L in SV-60 along the northern boundary (See Figure 15). At 20' bg, soil gas concentrations of cis-1,2 DCE were also identified along the southern, northern, and eastern property lines (See Figure 16). Three soil gas points in the permeable sands at 20' bg identified cis-1,2 DCE concentrations above 1,000 µg/L. One of the soil gas concentrations was located to the north in SV-64 as 3,200 µg/L and two soil gas concentrations were located along the southern property boundary in SV-43 and SV-47 as 1,200 µg/L and 1,000 µg/L, respectively. The soil gas cis-1,2 DCE concentrations identified an areally pervasive plume which suggests both an on-site and off-site source exist at 20' bg.

No significant soil gas concentrations of the parent compound PCE were identified by the SGS performed by BEII. Soil gas PCE concentrations were detected at 5' bg along the south property boundary at a maximum of 25 µg/L in SV-42 (See Figure 17). At 7' to 12' bg, PCE in

port of Findings
rmer Angeles Chemical Company
02-171
tober 15, 2002

il gas was detected greater than 5 µg/L in only two locations, SV-42 and SV-60 (See Figure). Concentrations of PCE in soil gas were detected north of the property at a maximum of 59 µg/L in SV-64 at 20' bg (See Figure 19). PCE in soil gas was also identified at a concentration of 12 µg/L in SV-39 along the southern property line with two other soil gas points <100 µg/L used on sample dilution. These relatively low level concentrations indicate that PCE has either degraded or a small volume was released into the vadose zone.

Soil gas concentrations of the parent compound 1,1,1 TCA were identified along the southern property line at 5' bg with a maximum of 58 µg/L in SV-40 (See Figure 20). At 7' to 12' bg, 1,1,1 TCA concentrations in soil gas were identified along both the southern and northern property line. Soil gas 1,1,1 TCA concentrations were identified at a maximum concentration of 250 µg/L in SV-60 to the north (See Figure 21). Maximum 1,1,1 TCA soil gas concentrations along the south were identified as 79 µg/L in SV-40. The soil lithology is mostly silty clay from surface to 19' bg. Figure 22 identified 1,1,1 TCA concentrations in soil gas along both the southern, eastern, and northern property line at 20' bg. The highest 1,1,1 TCA soil gas concentration was identified in SV-64 at 4,300 µg/L along the north side of the property and 330 µg/L along the south side of the property. The soil gas 1,1,1 TCA concentrations suggest both an on-site and off-site source exist.

No significant soil gas concentrations of the parent compound TCE were identified by the SGS performed by BEII. Soil gas TCE concentrations were detected below 5 µg/L at 5' bg and 7' to 12' bg in the impermeable clays (See Figures 23 and 24). The highest concentrations of TCE in soil gas were identified along the north at 20' bg in permeable sands as 170 µg/L and 100 µg/L in SV-64 and SV-65, respectively. TCE in soil gas was also identified at 20' bg along the southern property line at a concentration of 7.5 µg/L in SV-39 and <100 µg/L in SV-40 and SV-41 due to sample dilution (See Figure 25). These relatively low level concentrations indicate that TCE has either biodegraded or a small volume was released into the vadose zone.

Concentrations of vinyl chloride (VC), a transform compound of 1,1 DCA, 1,1 DCE, and cis 1,2 DCE, were detected as <5 µg/L in soil gas at 5' bg and 7' to 12' bg in the impermeable clays (See Figures 26 and 27). At 20' bg, soil gas concentrations of VC were identified along the southern and northern property lines (See Figure 28). However, the two greatest soil gas concentrations were located along the southern property boundary in SV-40 and SV-46 as 250 µg/L and 200 µg/L, respectively. The maximum VC soil gas concentration along the north was 14 µg/L in SV-64. The elevated soil gas VC concentrations identified along the south side in the permeable soils suggest that an off-site source may exist.

All sampling was conducted according to the Field Sampling Plan and all duplicates and other quality assurance measures were conducted according to the Quality Assurance Project

**Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002**

Plan, which were submitted in a work plan to the DTSC in April 2002. The above work was performed under the direct supervision of a California Registered Professional Engineer.

In an attempt to determine the extent of soil gas concentrations beneath the subsurface, BEII combined the results of the 2002 SGS with those from the 2001 SGS. However, because the soil gas samples were taken one year apart the concentrations may not be representative of current site conditions. Figures 29 through 36 depict an estimated extent of soil gas concentrations at 20' bg for BTEX, 1,1 DCA, 1,1 DCE, cis-1,2 DCE, PCE, 1,1,1 TCA, TCE, and VC, respectively, based on the 2001 and 2002 SGS data combined.

7.0) BORING AND GROUNDWATER WELL SAMPLE COLLECTION

BEII advanced two soil borings (BSB-1 and BSB-2) and installed two groundwater monitoring wells (MW-8 and MW-9) on the Angeles site from June 5 to June 7, 2002. The purpose of the drilling was to help define the lateral and vertical extent of impacted soil along the eastern Angeles property line and to help determine the extent of impacted groundwater. The work was approved and performed under the supervision of the DTSC, the lead regulatory agency overseeing the site and the direct supervision of a registered civil engineer.

The locations of the two soil borings and two groundwater monitoring wells were selected based on previously collected site information and based on site data gaps (See Figure 37 for BEII well/boring locations). Soil samples were collected at significant changes in lithology, at observed signs of contamination, and as specified by on-site DTSC staff, Mr. Sanford Britt. Soil borings BSB-1 and BSB-2 were advanced to 50' bg and 30' bg, respectively. Monitoring wells MW-8 and MW-9 were installed to 40.5' bg and 45.5' bg, respectively (See Appendix B for Boring Logs/Well Construction). On-site BEII staff and DTSC staff were in agreement on boring termination, depths of soil sample collection, and well construction.

Subsurface samples were continuously cored and logged via a boring to the desired sample depth using a hollow stem auger drill rig equipped with a continuous core sampler to collect detailed information on site geology. Once the desired sample depth was reached, cuttings were set aside in a boring-dedicated container or on a boring-dedicated disposable tarp. A decontaminated continuous core sampler device was inserted into the hollow stem auger and advanced with the auger as to collect an undisturbed soil sample. The sampler contained two 3-inch by 30-inch clear acrylic liners for sample collection. All soil borings were logged by experienced field staff under the oversight of a Civil Engineer appropriately licensed in California. Soil borings were logged using the Unified Soil Classification System (USCS).

Samples to be analyzed for VOCs were collected first. Soil samples collected for VOC analysis were collected in accordance with EPA Method 5035 using the methanol and sodium

**Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002**

bisulfate field extraction protocol as submitted in the Subsurface Investigation Work Plan dated April 25, 2002. In order to provide the lowest detection limits possible, a total of two aliquots with sodium bisulfate were collected of each sample so that multiple-dilution runs can be performed by the laboratory. Selected soil samples were also analyzed for metals using EPA 7000 series, semi-volatile organic compounds (SVOCs) using EPA method 8270C, and total petroleum hydrocarbons (TPH) using EPA method 8015M. Samples were immediately placed in an iced cooler and processed for shipment to the laboratory. This procedure was repeated until all sampling depths were sampled. The borings were backfilled with bentonite chips and hydrated. The surface was repaired to match the surrounding surface. Details of the field sampling procedures, decontamination, waste containment, and waste removal procedures were included in the Subsurface Investigation Work Plan dated April 25, 2002, Appendix D, Field Sampling Plan.

Each new monitoring well was developed by swabbing and bailing three days after well installation. Development was conducted by swabbing and bailing in order to adequately clear the filter pack of formation fines. Completion of development was limited by two complete dewatering episodes in each well during repeated surging of the well by bailing. A total of 65 gallons of water was removed from MW-9 and 55 gallons of water was removed from MW-8 during well development. Development water was containerized on-site for disposal at a later date. Purging and sampling was conducted 4 days after well development. Groundwater samples were collected from the newly installed wells on June 14, 2002 during the next quarterly groundwater sampling event. Groundwater samples were collected and analyzed according to the October 23, 2001 Groundwater Monitoring Work Plan which was submitted and approved by the DTSC.

8.0) BORING AND GROUNDWATER WELL SOIL SAMPLE RESULTS

Visual inspection of the clear liners identified a silty clay to clay matrix from surface to a maximum depth of 19' bg in MW-8. An inter-bedded layer of sand exists from 10' bg to a maximum depth of 40' bg in MW-8. The sand is underlain with a silty clay to clay layer starting at 25' bg. The bottom impermeable silty clay/clay layer identified a maximum thickness of 22.5 feet in BSB-1 based on visual inspection of the clear liners. Groundwater was encountered in MW-8 and MW-9 at approximately 30' bg. Three soil samples from the fine-grained unit (0' to 15' bg) and three soil samples from the coarse-grained unit were submitted for laboratory analysis for physical parameters (See Appendix C for laboratory results). Sample results identified a permeability characteristic of fine-grained soils (10^{-6}) from 0' to 15' bg and a permeability characteristic of fine-grained soils (10^{-4}) from 15' to 30' bg.

Two cross sectional depictions of the site geology were based on the continuous core samples and previous geological descriptions by SCS. A more detailed cross-section will be

Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002

displayed once a site survey has been performed. Figure 38 shows the site lithology from south to north along A-A'. A permeable sand layer was identified site wide between 25' and 35' bg. The lithology identified monitoring well MW-8 as a low point ("sump") in the permeable sand. The sand layer between MW-1 and MW-8, a distance of 116 feet, dips from south to north with a 10-foot change in elevation. The sand then slopes back up from south to north just north of MW-8. Figure 39 shows the site lithology from west to east along B-B'. A permeable sand layer was identified site wide between 25' and 34' bg. The west-east lithology further supports that monitoring well MW-8 is a low point ("sump") in the permeable sand.

Soil sample analysis results from boring BSB-1 identified low levels of TPH as gasoline near surface at 1.5' bg (1.6 mg/kg) and along a lithologic boundary between sand and clay at 28' bg (1.2 mg/kg). No other detectable concentrations of TPH as gasoline were contained in the remaining eight soil samples analyzed for gasoline (See Table 4). TPH as diesel and motor oil were not detected in all ten soil samples analyzed for those compounds. Three soil samples collected from BSB-1 at 1.5' bg, 6.5' bg, and 10.5' bg were analyzed for metals and SVOCs (See Tables 5 for metals). Arsenic was detected as 8.8 mg/kg and 2.4 mg/kg at 6.5' bg and 10.5' bg, respectively. The EPA Preliminary Remediation Goals (PRGs) set for arsenic in residential soil is 22 mg/kg (non cancer endpoint) and 0.39 mg/kg (cancer endpoint). All remaining soil sample analysis results for metals were below their respective PRGs. No detectable concentrations of SVOCs were identified from BSB-1 in the three soil samples analyzed and were therefore not tabulated (See Appendix C for Laboratory Analytical Results).

A total of nine soil samples from BSB-1 were analyzed for seventy-one VOCs using EPA method 8260. Only seven VOCs (1,1 DCE, 1,1 DCA, cis-1,2 DCE, 1,1,1 TCA, Xylene, 1,2,4-Trimethylbenzene, and Naphthalene) were identified above detectable concentrations from the nine soil samples (See Table 6 for detected VOCs). Laboratory analysis identified maximum 1,1 DCE and 1,1,1 TCA concentrations as 222 µg/kg and 550 µg/kg at the bottom of the encountered sand layer at 27.5' bg. Concentrations attenuate to 80 µg/kg as 1,1 DCE at 45' bg and to <5 µg/kg as 1,1,1 TCA at 40' and 45' bg. Maximum 1,1 DCA and cis-1,2 DCE soil sample concentrations were identified at 28' bg, the top of an encountered clay layer in BSB-1. 1,1 DCA concentrations attenuate from 745 µg/kg at 28' bg to 148 µg/kg at 45' bg in soil. Cis-1,2 DCE concentrations attenuate from 1,580 µg/kg at 28' bg to 125 µg/kg at 45' bg in soil. Soil sample concentrations of Xylene, 1,2,4-Trimethylbenzene, and Naphthalene were detected exclusively at the top of the encountered clay layer at 28' bg as 130 µg/kg, 120 µg/kg, and 85 µg/kg, respectively.

Laboratory analysis results identified no detectable concentrations of TPH as gasoline in six soil samples collected from BSB-2. TPH as diesel and motor oil were not detected in all three soil samples analyzed for those compounds from BSB-2. Three soil samples collected from BSB-2 at 1.5' bg, 6.5' bg, and 11.5' bg were analyzed for metals and SVOCs. Arsenic was

Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002

detected in all three samples as 8.9 mg/kg, 3.2 mg/kg, and 3 mg/kg at 1.5' bg, 6.5' bg and 11.5' bg, respectively. The concentrations are above the PRG cancer endpoint (0.39 mg/kg) set for arsenic in residential soil. All remaining soil sample analysis results for metals were below their respective PRGs. No detectable concentrations of SVOCs were identified from BSB-2 in the three soil samples analyzed and were therefore not tabulated.

A total of six soil samples from BSB-2 were analyzed for seventy-one VOCs using EPA method 8260. Only five VOCs (1,1 DCE, 1,1 DCA, cis-1,2 DCE, 1,1,1 TCA, and PCE) were identified above detectable concentrations from the six soil samples. Laboratory analysis identified maximum 1,1 DCA and 1,1,1 TCA concentrations as 35 µg/kg and 55 µg/kg at 18' bg, the top of the encountered sand layer in BSB-2. Concentrations of both VOCs attenuate to non-detect at 21' bg. Soil sample results, however, identified an increase of 1,1 DCA as 18.5 µg/kg and 1,1,1 TCA as 42.5 µg/kg at 26.5' bg, near the top of an encountered clay layer. Soil sample concentrations of 1,1 DCE and cis-1,2 DCE were detected exclusively near the top of the encountered clay layer at 26.5' bg as 9.1 µg/kg and 22 µg/kg, respectively. PCE was identified in clayey soils at 14' bg exclusively as only 6.8 µg/kg.

Eleven soil samples were analyzed for TPH as gasoline from MW-8. TPH as gasoline was detected from 24' bg to 42.5' bg, which consisted mostly of a sandy matrix. The maximum TPH as gasoline concentration was identified in soil as 3,120 mg/kg at 32.5' bg and attenuates to 7.6 mg/kg at 42.5' bg in a clay layer. Concentrations of TPH as diesel were detected from 30' to 40' bg in an encountered sand layer with a maximum of 456 mg/kg at 32.5' bg. No detectable concentrations of TPH as diesel were identified at 42.5' bg in the encountered clay. TPH as motor oil was not detected in all ten soil samples analyzed for those compounds. Three soil samples collected from MW-8 at 1.5' bg, 6.5' bg, and 11.5' bg were analyzed for metals and SVOCs. Arsenic was detected in all three samples as 2 mg/kg, 8.3 mg/kg, and 1.2 mg/kg at 1.5' bg, 6.5' bg and 11.5' bg, respectively. The concentrations are above the PRG cancer endpoint (0.39 mg/kg) set for arsenic in residential soil. All remaining soil sample analysis results for metals were below their respective PRGs. No detectable concentrations of SVOCs were identified from MW-8 in the three soil samples analyzed and were therefore not tabulated.

A total of eleven soil samples from MW-8 were analyzed for seventy-one VOCs using EPA method 8260. Only seventeen VOCs (1,1 DCE, 1,1 DCA, cis-1,2 DCE, 1,1,1 TCA, 1,2 DCA, TCE, PCE, Isopropylbenzene, Benzene, Toluene, Ethylbenzene, Xylene, n-Propylbenzene, 1,3,5-Trimethylbenzene, 1,2,4-Trimethylbenzene, n-Butylbenzene, and Naphthalene) were identified above detectable concentrations from the eleven soil samples. All detected VOCs from MW-8 were at a maximum concentration at 32.5' bg, the depth groundwater was encountered. Soil sample analysis results identified low levels of 1,1 DCA, cis-1,2 DCE, and 1,1,1 TCA (maximum of 247 µg/kg at 19' bg) in both clay layers encountered in MW-8. Maximum concentrations of 1,1 DCA, cis-1,2 DCE, and 1,1,1 TCA (up to 42,800

Report of Findings
Former Angeles Chemical Company
702-171
October 15, 2002

g/kg at 32.5' bg) were detected in an encountered permeable sand layer from 19' bg to 40' bg. Laboratory analysis identified maximum 1,1 DCE as 1850 µg/kg within the encountered sand layer at 32.5' bg. Concentrations of 1,1 DCE attenuate to <5 µg/kg at 35' bg then increase to 35 µg/kg in clay at 42.5' bg. Toluene, Ethylbenzene, Xylene, 1,3,5-Trimethylbenzene, and 1,2,4-Trimethylbenzene soil sample concentrations were first identified in a permeable sand layer from 29' bg to 40' bg (up to 161,000 µg/kg). Concentrations of these VOCs attenuate by at least two orders of magnitude at 42.5' bg in an encountered clay layer. Soil sample results also identified elevated concentrations of Isopropylbenzene, n-Propylbenzene, n-Butylbenzene, and Naphthalene from 29' bg to 40' bg in the same permeable sand layer. However, soil sample concentrations of all four VOCs attenuate to <5 µg/kg at 42.5' bg in an encountered clay layer. Maximum TCE soil sample concentrations were identified at 35' bg, within an encountered sand layer in MW-8. TCE concentrations attenuate from 460 µg/kg at 35' bg to <5 µg/kg at 42.5' bg in soil. Benzene, 1,2 DCA, and PCE were detected exclusively at one depth; 62.5 µg/kg at 42.5' bg, 4950 µg/kg at 30' bg, and 160 µg/kg at 40' bg, respectively.

Soil sample analysis results from MW-9 identified TPH as gasoline exclusively at 15' bg as 1.3 mg/kg. No other detectable concentrations of TPH as gasoline were contained in the remaining nine soil samples analyzed for gasoline. TPH as diesel and motor oil were not detected in all ten soil samples analyzed for those compounds. Two soil samples collected from MW-9 at 3' bg and 5.5' bg were analyzed for metals and SVOCs. Arsenic was detected in both samples as 6.5 mg/kg and 6 mg/kg at 3' bg and 5.5' bg, respectively. The concentrations are above the PRG cancer endpoint (0.39 mg/kg) set for arsenic in residential soil. All remaining soil sample analysis results for metals were below their respective PRGs. No detectable concentrations of SVOCs were identified from MW-9 in the two soil samples analyzed and were therefore not tabulated.

A total of ten soil samples from MW-9 were analyzed for seventy-one VOCs using EPA method 8260. Only six VOCs (1,1 DCE, 1,1 DCA, cis-1,2 DCE, 1,1,1 TCA, TCE, and PCE) were identified above detectable concentrations from the ten soil samples. Laboratory analysis identified maximum 1,1 DCA and 1,1,1 TCA concentrations as 95 µg/kg and 35 µg/kg at 29' bg at the bottom of an encountered sand layer. Concentrations attenuate to <5 µg/kg as 1,1 DCA at 50' bg and to <5 µg/kg as 1,1,1 TCA at 35' bg. Maximum 1,1 DCE soil sample concentrations were identified at 35' bg in an inter-bedded clay layer and maximum cis-1,2 DCE soil sample concentrations were identified at 29' bg in an encountered sand layer in MW-9. 1,1 DCE concentrations attenuate from 85 µg/kg at 35' bg to 21.8 µg/kg at 50' bg in soil. Cis-1,2 DCE concentrations attenuate from 400 µg/kg at 29' bg to <5 µg/kg at 50' bg in soil. Soil sample maximum concentrations of PCE and TCE were detected at 3' bg as 24.8 µg/kg and 6.7 µg/kg, respectively.

IF CO case
NB. Not that in
table?

Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002

9.0) CONCLUSIONS

Based on the SGS data, BEII concludes that an on-site and off-site source of VOCs in soil gas exists or existed in the subsurface beneath the former Angeles Chemical Company site. Soil gas sample results identified higher concentrations ($>1,000 \mu\text{g/L}$) as VOCs along the southern property boundary and along the northern on-site railroad spurs. These soil gas concentrations indicate an off-site source to the south and an on-site source along the railroad spurs.

Furthermore, soil gas concentrations of transform compounds (1,1 DCA, 1,1 DCE, cis 1,2 DCE, VC) were significantly higher than parent compounds (PCE, 1,1,1 TCA, and TCE). Transform compounds 1,1 DCA, 1,1 DCE, and cis 1,2 DCE were identified at concentrations greater than $1,000 \mu\text{g/L}$ a total of 10 times with a maximum of $3,200 \mu\text{g/L}$ as cis- 1,2 DCE. The parent compound 1,1,1 TCA identified concentrations greater than $1,000 \mu\text{g/L}$ a total of four times with a maximum of $4,300 \mu\text{g/L}$. No other parent compounds were identified over $59 \mu\text{g/L}$. Based on the SGS data, BEII also concludes that the parent compounds have decreased and transform compounds have increased, which is a primary indication of biodegradation.

Visual inspection of continuous core samples identified monitoring well MW-8 as the lowest point in the site wide permeable sand layer from 25' bg to 35' bg. The sand layer slopes down from south to north to MW-8 and then slopes up. The sand layer slopes down from west to east to MW-8 and then slopes up. Based on the lithology, BEII concludes that MW-8 is the sump of the permeable sand layer that slopes down from the south. Therefore, any off-site releases from neighboring properties to the south may significantly impact the subsurface under the Angeles site should their releases reach the permeable sands.

BEII also concludes that the soil is mostly impacted by VOCs within the permeable sand layer. Soil sample results identified only four VOCs in the upper clay layer from 0' to approximately 20' bg. Total VOC soil concentrations averaged $56.66 \mu\text{g/kg}$ in the upper clay zone. Soil sample results identified elevated VOC concentrations in sand with lower to no detectable concentrations in the underlying clay layer. The average total VOC soil concentrations were $53,125 \mu\text{g/kg}$ in the permeable sand layer. The underlying clay layer identified an average total VOC soil concentration of $408 \mu\text{g/kg}$. Soil sample analysis results identified VOC concentrations at a minimum of two orders of magnitude higher within the permeable sand layer than in the impermeable clays.

10.0) RECOMMENDATIONS

Based on the results of the recent subsurface investigation, BEII recommends the advancement of several cone penetrometer test (CPT) locations and eight additional soil borings

Report of Findings
Former Angeles Chemical Company
0702-171
October 15, 2002

to further define the lithology of the site and aid in the delineation of subsurface contaminants (See Figure 40 for proposed CPT/boring locations). A detailed lithologic cross section will be provided from the results and the site survey to be performed. Soil sampling will be performed according to the Subsurface Investigation Work Plan dated April 25, 2002. Groundwater sampling will be performed according to the Groundwater Monitoring Work Plan dated April 25, 2002.

● Gage/Hollydale Aquifer Monitoring Wells

★ Perched Water Monitoring Wells

DECOMMISSIONED AND
SLURRY FILLED USTs

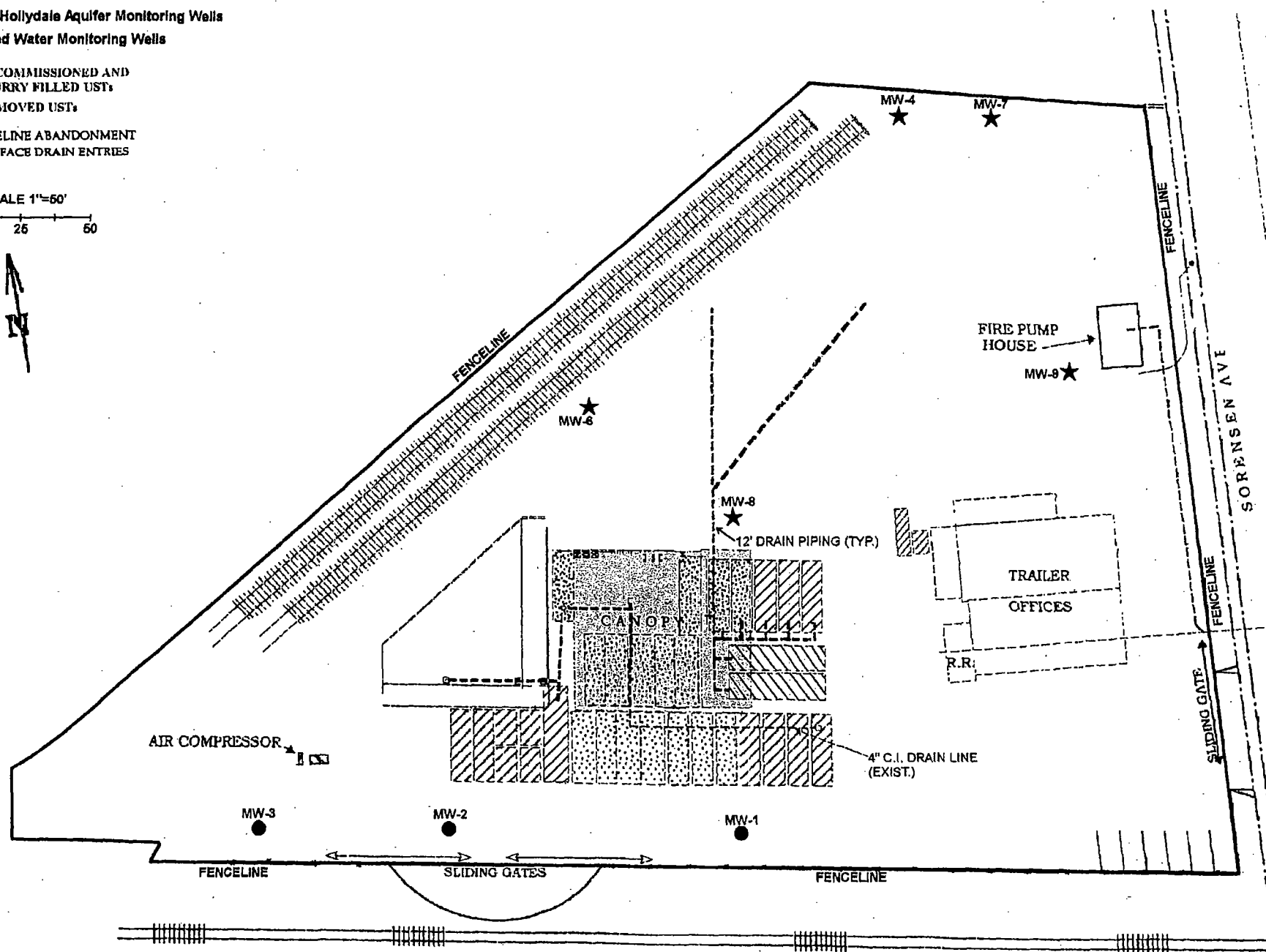
REMOVED USTs

PIPELINE ABANDONMENT

SURFACE DRAIN ENTRIES

SCALE 1"=50'

0 25 50



Blakely Environmental
Investigations, Inc.
9605 Arrow Route, Suite "T"
Rancho Cucamonga, CA 91730

Well Location Map

Former Angeles Chemical Company
8915 Sorensen Avenue, Santa Fe Springs, CA

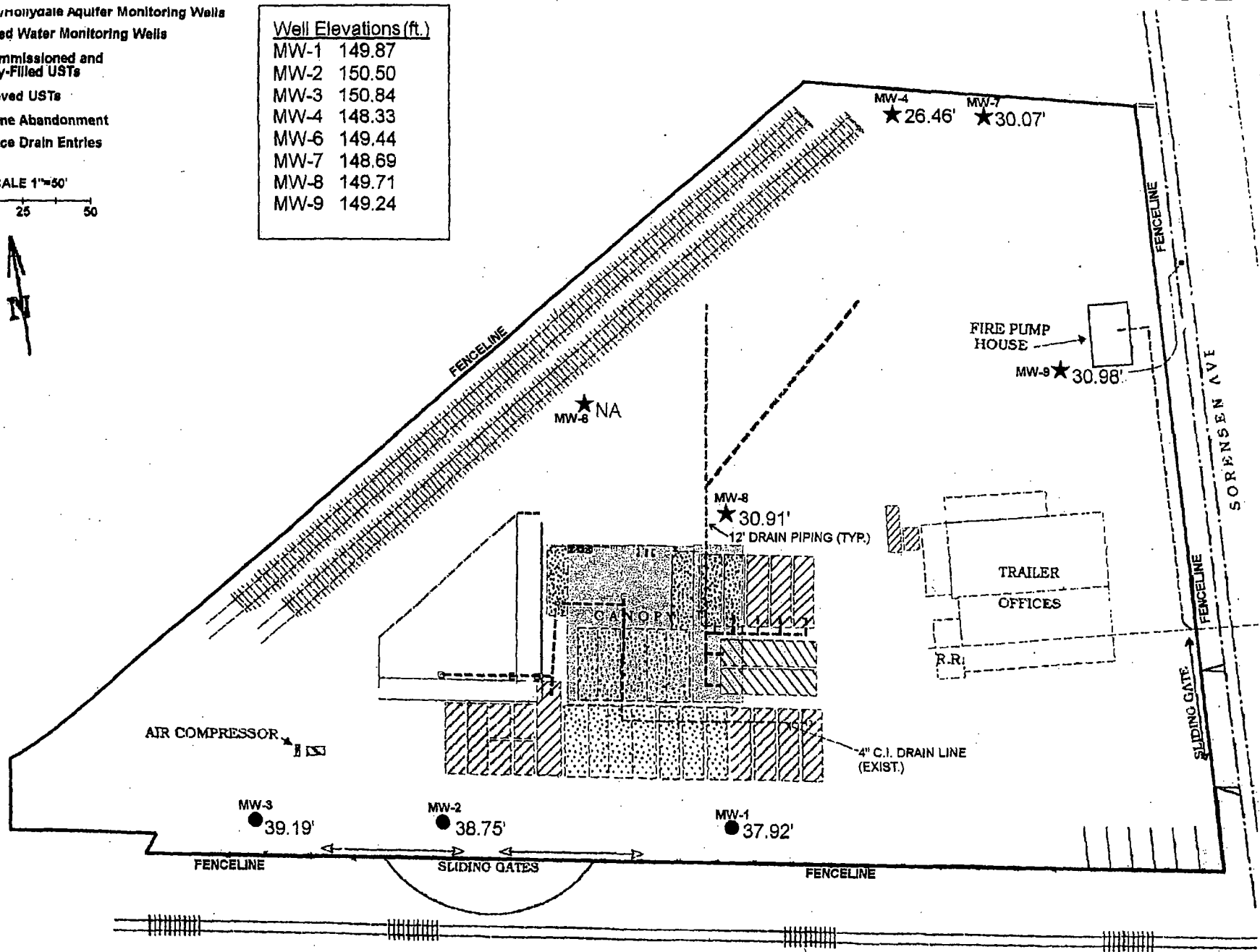
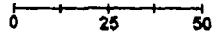
FIGURE 2

- Sage/Highgate Aquifer Monitoring Wells
- ★ Perched Water Monitoring Wells
- ▨ Decommissioned and Slurry-Filled USTs
- ▧ Removed USTs
- - - Pipeline Abandonment
- Surface Drain Entries

Well Elevations (ft.)

MW-1	149.87
MW-2	150.50
MW-3	150.84
MW-4	148.33
MW-6	149.44
MW-7	148.69
MW-8	149.71
MW-9	149.24

SCALE 1"=50'



**Blakely Environmental
Investigations, Inc.**
9605 Arrow Route, Suite "T"
Rancho Cucamonga, CA 91730

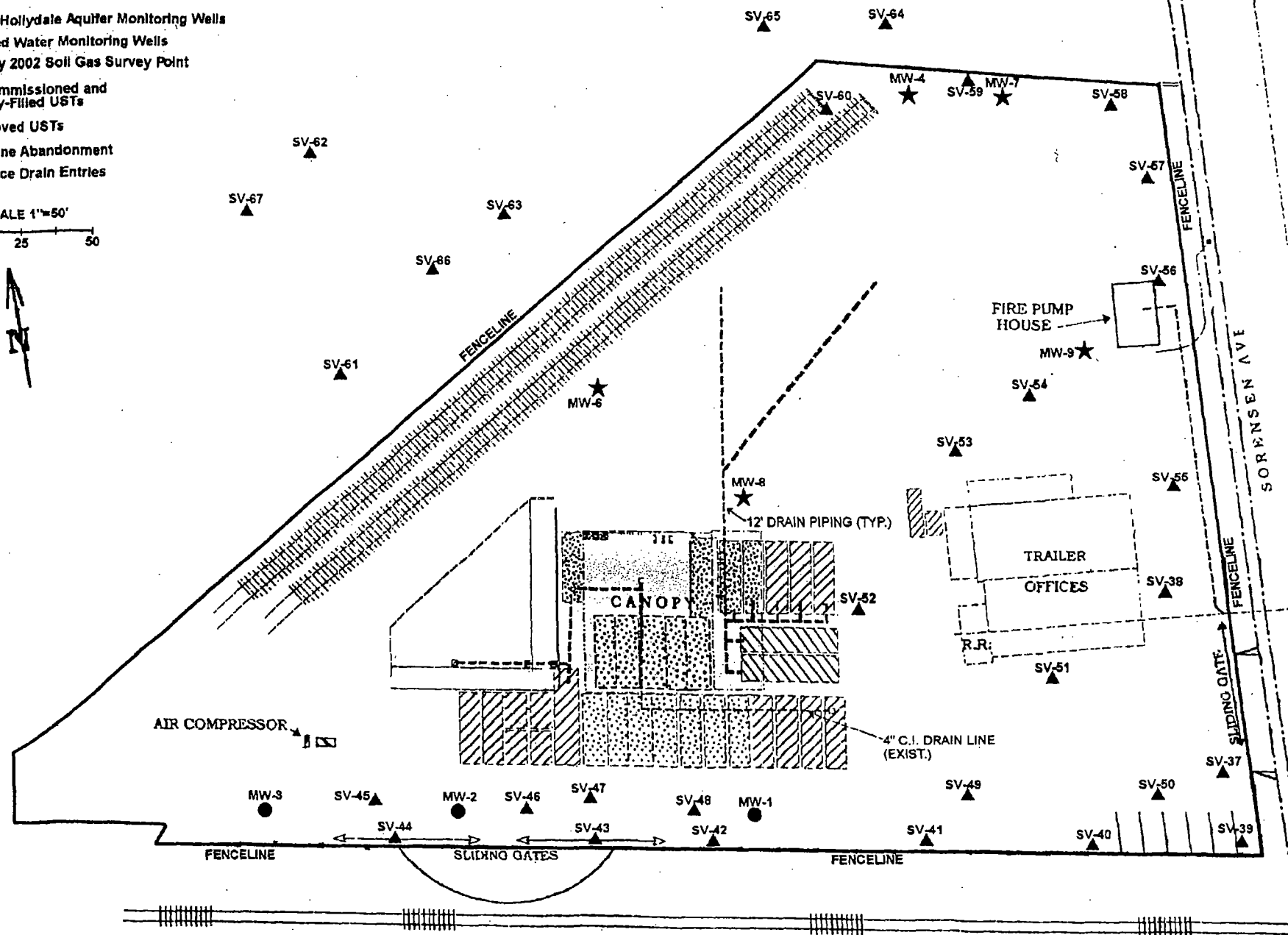
Depth to Groundwater
Former Angeles Chemical Company
8915 Sorensen Avenue, Santa Fe Springs, CA

FIGURE 3

- Gage/Hollydale Aquifer Monitoring Wells
- ★ Perched Water Monitoring Wells
- ▲ January 2002 Soil Gas Survey Point
- ▨ Decommissioned and Slurry-Filled USTs
- ▧ Removed USTs
- - - Pipeline Abandonment
- Surface Drain Entries

SCALE 1"=50'

0 25 50



**Blakely Environmental
Investigations, Inc.**
9605 Arrow Route, Suite "T"
Rancho Cucamonga, CA 91730

BEI Soil Gas Sample Locations
Former Angeles Chemical Company
8915 Sorensen Avenue, Santa Fe Springs, CA

FIGURE 4